

NOTES ON THE AQUATIC HABITATS OF MACROHYDROPHYTES AND
ASSOCIATED ALGAE IN VARIOUS REGIONS IN EGYPT
I. EL-FAYUM REGION

W.S. Abou-El Kheir and G.H. Ismail
University College for Girls, Ain Shams University, Heliopolis, Egypt.

INTRODUCTION

El-Fayum region is situated on the left bank of the Nile about 90 kilometer to the south west of Cairo. Lake Qarun lies in the north west of this region. The cultivated lands are naturally irrigated by a number of canals derived from Bahr-Yossef River, which receives its water from the Nile. The irrigation-water drains off into the lake by two main drains.

Earlier works on the algae of El-Fayum (see Aleem, 1958; El-Saadawi et al., 1978; Nosseir and Abou-El-Kheir, 1970; Shaaban et al., 1985; West, 1909) were mainly concerned with the distribution of the extinct and extant algal floras, the effect of nutrients on production...etc.

However, little is known of the relationship between algae and macrohydrophytes in Egypt; the only two publications dealing with this subject were done on lake Mariut (Kaleafah, 1964) and the Mansoura-Damietta area (Ayyad, 1980). Kaleafah, (1964) studied the ecology of algae in lake Mariut and found that Enteromorpha, Rhizoclonium, Oedogonium and Cladophora were epiphytic on Phragmites communis, Potamogeton pectinatus and Typha latifolia. While Ayyad (1980), working on water bodies in the Mansoura-Damietta area, observed that Synedra ulna var. ulna, S. ulna var. amphirhynchus, Achnanthes hungarica, A. lanceolata, Cocconeis placentula var. euglypta, C. placentula var. intermedia, Phinnularia microstaurum var. brebissonii, Nitzschia amphibia, N. thermalis, Bacillaria paradoxa, Amphora veneta, and Gomphonema angustatum var. productum from class Pinnatophyceae and only Cyclotella ocellata from class Centropyceae were found on the surface of Ceratophyllum demersum, Potamogeton crispus, Pistia stratiotes, Nymphaea lotus and Lemna gibba.

Prowse (1959) stated that little is known about the relationship of epiphytes with their hostplants, or more particularly, whether certain species of algal epiphytes are associated with species of macrophytes. Sheldon and Charles (1975) recorded that diatoms were the dominant population of epiphytic algae in oligotrophic lake. Ewinson (1978) noticed that the increase of nutrients increased the diatom epiphytes and decreased the aquatic hydrophytes.

Some work has been done on certain aspects of relationship between algae and other plants; algal hydrophytes, lichens and algamoss-associations (see for example; Fritsch, 1959; Chapman, 1964; Prescott, 1969; El-Saadawi and Abou-El Kheir, 1973; Richardson, 1981; Abou-El Kheir et al., 1986; and El-Saadawi et al., 1986).

The present investigation deals with association aspects between algae and macrohydrophytes in different water ecosystems including flowing and standing systems and a study of the possible effects of major physical and chemical factors upon their pattern of distribution.

MATERIAL AND METHODS

Fifteen samples, used in this study, were taken from 12 sites in El-Fayum region. The samples were collected from irrigation canals, drains, springs and Lake Qarun.

Field ecological notes were recorded such as width and depth of the water channel, water current velocity, surface water temperature, and pH. Data concerning description of habitats, characters of the macrophyte communities, the main associated algal flora in the 12 studied sites, and other details are presented in table 1.

Clearing of diatoms, identification of the algal taxa associated with the aquatic plants and determination of the various nutrients in the samples were made.

RESULTS AND OBSERVATIONS

Data concerning water analysis of the 15 studied samples and algal flora identified in them are given in tables 2 and 3.

It has been noticed that, when the habitat was a narrow drain with nearly stagnant water, dominant macrophytes were Typha domingensis and Phragmites australis, and were associated with Oedogonium capilliformis as dominant, with common occurrence of planktoner Nitzschia frustulum and the blue green alga Mastigocladus laminosus.

At an irrigation canal (Maymana canal), under open running water, was noted dominance of Cladophora glomerata with epiphytic Cocconeis placentula var. intermedia.

At kaabi irrigation canal, the habitat offered a study of a striking change on the two sides of the little barrage present, with quiet water on one side, site 5a, and extremely fast-falling water from the water gates on the other side, site 5b, on the almost quiet water side dominated Potamogeton nodosus associated with the planktoner Cyclotella ocellata; while under the water fall, Cladophora glomerata dominated as epilithic to the barrage stones flooded with extremely fast flowing water. Cladophora glomerata extended as dominant in the fast flow in open water at distance from the barrage, site 5c.

A narrow drain, 5 km from El-Fayum city, with stagnant water completely covered with floating Lemna gibba fronds at surface and with Typha domingensis at sides. This lentic water habitat showed association of Oedogonium capilliformis as dominant and Spirogyra varians and Achnanthes hungarica as common.

A water spring habitat is presented by Silene spring, site 8. The habitat represents a small channel with fast flowing open water and macrophytes at bank sides. Examination has shown almost rare or lack of planktonic or benthic algal flora.

At sites 9-12, the habitat is the salty Qarun lake with Phragmites australis dominating at this southern shoreside, associated with usually rare algal flora due to high salinity; only rare new records of salinity tolerant taxa were recorded.

CONCLUDING REMARKS

Variation in algal taxa under the different studied habitats including fresh water of irrigation canals, field drains, spring water, salty lake water, has been noticed and this is dependent on various ecological factors of ecosystems: The association is brought about by similarity of ecological amplitude of certain aquatic plants and certain algae or dependence of one species of algae upon another of aquatic plants for epiphytism, protection, suitable light intensity, or formation of suitable microhabitat or substratum for the algae.

Phragmites australis has the widest ecological amplitude on all studied macrohydrophytes (see table 1). Since it is present in almost half the number of the sites. The diatoms dominate over other divisions of algae. The most common diatoms that occur in association with the studied hydrophytes are: Cocconeis placentula v. intermedia, Achnanthes hungarica, Gomphonima gracile, Nitzschia frustulum and Cyclotella ocellata Rivera (1973), Marker and Gunn (1977), Moor (1979) and Ayyad (1980) suggested that the productivity of epiphytons is dependent mainly on the growth of certain pinnate diatoms.

The number of green algal taxa was not high in almost all sites. There was an extensive growth of Cladophora glomerata, Spirgyra varians, Oedogonium Capilliformis, O. princeps and Ulothrix oscillarina. This is in agreement with Kalefah (1964) and Ayyad (1980).

Although the number of taxa belonging to cyanophyta is larger than that of chronophyta yet not a single taxon of cyanophyta was found common only in site No. 1, which means that the water sources from which the samples were taken are not the ideal habitat for the blue-green algae. This clear especially in samples of open water where cyanophyta are rare. This in agreement with Moor (1974).

As salinity is high in lake Qarun where Phragmites australis is dominant, only rare algae were recorded. Gran (1929), Patrick (1948) and Nasr et al. (1961) pointed out that the kind and distribution of algae is greatly affected by the change of salinity of water.

Extremely fast flowing water affected algal distribution. Under such condition only such alga as Cladophora glomerata may thrive being attached to stony substratum at kaabi barrage, site 8, this is in agreement with Lund (1965), who stated that fast flowing rivers may lack a true plankton, because there is insufficient time for the algae to produce effectively.

Round (1960, 1965), noticed that Chlorophyta occur in water with high ratio of alkali/Ca+Mg. The results obtained here are in agreement with this statement, thus Cladophora glomerata and Spirogyra varians were found abundant in the present study where values of Ca and Mg were high (Table 2).

The lack of planktonic or benthic algal flora in Silene spring habitat may be explained as the source of water is the ground deep water and thus the change for algal community development becomes little for this reason and also as water flow in the channel is so fast.

Table(1): Habitat, macrohydrophyte communities and main algal flora in El-Fayum region. d. dominant, cod = codominant, c = common.

Site No.	Date of collection	Habitat & locality	Flowing velocity	Temperature	pH	Macrohydrophyte plant community	Dominant and common algae
1	19/1/79	Narrow drain near Irtitulum farm El-20'ol village, Senoures (20 km before Fayum)	Nearly Stagnant	16°C (12:0 N)	7.0	Typha domingensis Phragmites australis Lemna gibba Drain side plants: Salicornia frutescens Coryza limifolia	Bacillariophyta: Nitzschia frustulum Chlorophyta: Oedogonium (spilloforme) Ullothrix oscillarina Cyanophyta: Nostocladus laminosus Bacillariophyta: Comphonemia gracile Nitzschia frustulum Chlorophyta: Oedogonium (spilloforme) O. princeps Bacillariophyta: Coconeis plicentula var. intermedia Chlorophyta: Cladophora glomerata Bacillariophyta: Cyclotella ocellata
2	"	Narrow water drain El-20'ol village (19 km before Fayum).	Almost quiet	16°C (12:10 p.m.)	7.0	Lemna gibba Phragmites australis Drain side plants: Cyperus alternifolius Salicornia frutescens	d c d c c
3	"	Irrigation stream (fresh water) from Waymana channel	Running water	16°C (12:30 p.m.)	7.0	Open water	d c c c
4	"	Irrigation canal (fresh water) 16 km before Fayum	Almost quiet	16°C (12:50 p.m.)	7.0	Phragmites australis	d
5	"	Irrigation canal Kaabi (fresh water) Kaabi village before Fayum barrage with quiet water site(a) and a fast falling water site(b).	a- Almost quiet b- Fast flowing c: 1.4m/sec.	16°C (1:15 p.m.)	7.0	Potamogeton nodosus Lemna gibba Eichhornia crassipes Open water Canal side: Polygonum salicifolium	d c c d d d
6	"	Irrigation stream (fresh water) under shade of trees Fayum's road	almost quiet	16°C (1:40 p.m.)	7.0	Open water Stream side plant: Cynodon dactylon Imperata cylindrica Coryza limifolia	Bacillariophyta: Coconeis plicentula var. intermedia c c c d
7	"	Narrow drain 5 km before Fayum	Almost stagnant	16°C (2:10 p.m.)	7.0	Lemna gibba Typha domingensis	d d c d c

Table (I): Cont.

Site No.	Date of collection	Habitat & locality	Flowing velocity	Temperature	pH	Macrohydrophyte plant community	Dominant and common algae
8	12/1/74	Saline spring channel, Silene.	1m/sec	16°C (2:30 p.m.)	7.0	Phragmites australis Eichhornia crassipes Channel side plants: Polygonum salicifolium Imperata cylindrica Coryza limfolia	d cod
9	"	Lake Qarun (saline water) southern shore, 20 Km from Fayum	Almost quiet	16°C (3:p.m.)	6.8	a: Phragmites australis Shore plants: Tamarix articulata. b: Open water	d Rare (new records) of Bacillariophyta
10	"	Lake Qarun (saline water)	almost quiet	16°C (3:10 p.m.)	6.8	Phragmites australis Shore plants: Salicornia fructicosa Avena latue, Juncus sp.	d rare
11	"	South shore Lake Qarun (saline water)	Almost quiet	16°C (3:20 p.m.)	6.8	Shore plants: Salicornia fructicosa Cyperus alternifolius	
12	"	Lake Qarun east side (saline water)	0.2 m/sec	16°C (3:30 p.m.)	6.8	Typha domingensis Shore plant: Juncus sp.	d

Table (2): Water analysis and algal flora (number of genera and species) in El-Fayum region.

Site No.	MINERALS (mg/l)								ALGAL FLORA						
	Cl	PO ₄	NO ₃	Ca	Mg	Na	K	Bacill g.	Sp.	Cyano. g.	Sp.	Chloro g.	Sp.	Euglen g.	Sp.
1	156.9	7.6	0.2	28.6	709.2	21.8	10.1	9	17	5	7	4	4	-	-
2	155.1	9.2	0.9	185.0	203.3	57.5	29.2	13	34	6	8	4	5	-	-
3	183.4	1.8	7.8	38.0	109.2	55.2	4.3	12	24	3	3	6	6	-	-
4	110.7	5.6	0.1	116.0	126.0	64.4	3.5	10	17	1	1	1	1	-	-
5a	184.5	18.2	0.2	47.8	16.2	46.0	7.8	14	37	5	5	5	5	-	-
b	184.5	18.2	0.2	47.8	16.2	46.0	7.8	12	22	8	9	6	7	-	-
c	184.5	18.2	0.2	47.8	16.2	46.0	7.8	16	25	4	4	1	1	-	-
6	137.2	10.2	1.4	12.0	348.0	39.1	29.6	14	33	-	-	1	1	-	-
7	72.1	9.2	0.6	43.8	78.6	20.7	9.4	9	20	4	4	3	4	-	-
8	325.4	2.1	1.0	42.0	12.0	39.1	11.7	2	2	2	2	-	-	-	-
9a	15620.0	3.6	5.6	1480.0	1542.0	9472.0	351.0	6	14	3	4	-	-	-	-
b	15620.0	9.2	9.8	630.0	1434.0	9782.0	195.0	5	7	2	2	1	1	1	1
10	14301.4	13.2	17.6	73.0	3204.0	1288.0	546.0	5	6	-	-	1	2	-	-
11	1301.6	7.6	0.7	210.0	210.0	149.5	35.1	14	27	5	5	1	1	-	-
12	8288.3	9.4	5.4	236.0	778.2	759.0	19.5	10	18	3	3	-	-	-	-

Samples No.		1	2	3	4	5a	5b	5c	6	7	8	9a	9b	10	11	12
Algal taxa																
Schizothrix arenaria (Berkeley) Gomont				r			r	r		r			r			
S. calcicola (Agardh) Gomont						p	r	r								
Spirulina fusiformis Woronich	p															
S. subsalsa Oersted								r								
Division: Chlorophyta:																
Characium acuminatum A. braun ex Kuetzing				r												
Cladophora glomerata (L.) Kütz			d				d	d	d							
C. vadorum (Areschoug) Kütz						r	r									
Chlorococcum humicolum (Naeg) Rabenh	r		r				r						r		r	
C. infusium (Schrank) Meneghini																
Coleochaeta divergens Pringsheim		r														
Oedogonium capilliforme Kütz	d	d	r				r			r						
O. princeps (Hass) Witt		c	r	r			r			p						
Pandorina Sp.						r	r									
Scenedesmus bijugatus (Turpin) Kuetzing	r	r	r				r									
S. quadricauda (Turp.) Brép						r										
Sphaeroplea africana Fritsch																
Spirogyra varians (Hass) Kütz																c
Trichophilus welckeri Weber von Bosse													r			
Ulothrix oscillariana Kütz																r
U. zonata (Weber et Mohr)	c	r														
Division: Euglenophyta:																
Protoeuglena noctilucae													r	r		

Acknowledgement

The authors are grateful to Dr. Mohamed A. Hammouda Professor of Botany at Ain Shams University for kind help and useful criticism.

References

- Abou El-Kheir, W.S., El-Saadawi, W.E. and Darwish, M.H.. 1986. A peculiar Algal-Moss association from El-Giza, Egypt. Arab. Gulf. J. Scient. Res. 4:69-75.
- Aleem, A.A., 1958. A taxonomic and Paleoecological investigation of the diatom flora of the extinct Fayum (Lake-Upper Egypt). Bull. Fac. Sci. Alex. Univ. 2: 99-217.
- Ayyad, S.M., 1980. Ecological studies on the Epiphytic algae inhabiting some Hydro-Macrophytes on Mansoura-Damieta area. M.Sc. Thesis Mansoura Univ. Egypt.
- Chapman, V.J., 1964. The algae. Macmillan, London.
- El-Saadawi, W.E. and Abou El-Kheir, W.S. 1973. On some Egyptian Mosses and the algal flora in their habitats. Proc. Egypt. Acad. Sci. 26:125-136.
- El-Saadawi, W.E., Badawi, A.A., Shaaban A.A. and El-Awamri, A.A., 1978. Pleistocene Diatoms from El-Fayum. Proc. Egypt. Acad. Sci. 31:257- 263.
- El-Saadawi, W.E., Abou El-Kheir, W.S. and Darwish, M.H. 1986. *Micropoma niloticum* (Del.) Lindb. (Musci) with Corm-Like stem bases. *Phytologia* 60:98-100.
- Ewinson, 1978. Cited from Ayyad, S.M., 1980: Ecological studies on the epiphytic algae inhabiting some hydro-macrophytes on Mansoura-Damietta area. M.Sc. Thesis Mansoura Univ., Egypt.
- Fritsch, F.E., 1959, 1961. The structure and reproduction of algae. Vols.I., II Cambridge Univ. Press.
- Gran, H.H. 1929. Investigation of the production of plankton outside the Romsdalsfjord 1926-1927. Perm. Int. Explor. Mer, Rapper Proc. Verb. 26(6) 1-112.
- Kaleafah, A.F., 1964. Ecology of algae in Lake Mariut. M.Sc. Thesis Fac. Sci. Alex. Univ.
- Lund, J.W.G., 1965. The ecology of the fresh water phytoplankton. *Biol. Rev.* 40:231-293.
- Marker, A.F. and Gunn R.J.M. 1977. The benthic algae of some streams in southern England. III-Seasonal variations in Chlorophyll a in the seston. *J. Ecol.* 65(1): 223-234.

- Moor, J.W., 1974. Benthic algae of Southern Baffin Island. III. Epilithic and epiphytic communities. *J. Phycol.* 10(4): 461-462.
- 1979. Distribution and abundance of attached littoral algae in 21 lakes and streams in the North West Territories. *Can. J. Bot.* 57:568-577.
- Nasr, A.H., Hashim, M.A. and Aleem. A.A., 1961. The flora of Lake Edku, with particular reference to benthic diatoms. *Bull. Fac. U.A.R.* 5: 219-234.
- Nosseir, M.A. and Abou el-Kheir, W.S., 1970. Effect of dissolved nutrients on the distribution of algal flora in selected lakes of U.A.R. I-lake Qarun. *Ann. Rev. Univ. Coll. for Girls, Ain Shams Univ., U.A.R.* No. 6, 15-24.
- Patrick, R., 1948. Factors affecting the distribution of diatoms. *Bot. Rev.* 14(8): 473-524.
- Prescott, G.W., 1969. *The algae: A review.* New York.
- Prowse, G.A., 1959. Relationship between epiphytic algal species and their macrophyte hosts. *Nature, Lond.* 183, 1204-5.
- Richardson, D.H.S., 1981. *The Biology of Mosses.* Blackwell Scientific Publ., Oxford.
- Rivera, P.R. 1973. Epiphytic diatoms on Gracillaria Verrucosa (Hudson) papenfuss collected along the Chilean Coast. *Gayana Bot.* 25:3-115.
- Round, E.F., 1960. Studies on Bottom-Living algae in some lakes of the English Lake. District Part IV. The Seasonal Cycle of the Bacillariophyceae. *J. Ecol.* 48:529-547.
- Round, E.F. and Happy, C.M. 1965. Persistent, vertical migration rhythms in benthic microflora. IV. A diurnal rhythm of the epipelagic diatom association in non-tidal flowing water. *Brit. Phycol. Bull.* 2, 463.
- Shaaban, A.S., and Badawi, A.A. and El-Awamri, A.A., 1985. Studies on the diatom of Bahr-Youssef irrigation canal and its branches in El-Fayum depression, (A.R.E.) Moshtohor. *Annals of Agricultural Science.* Vol. 24 (in press).
- Sheldon, R.B. and Charles, W.B. 1975. Factors affecting the contribution by epiphytic algae to the primary productivity of an oligotrophic fresh water lake. *Appl. Micro* 30(4): 567-667.
- West, W., 1909. The algae of Bircet Qarun, Egypt. *J. Bot.* Vol. 47, 1.